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## THE BEGINNING OF THE WEATHER BUREAU.

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(Read before the Society, December 19, 1916.)

American scientists may well be proud of the services rendered by their countrymen to humanity in adding to our knowledge of the atmosphere. The act of the great Franklin in drawing down the lightning of the clouds and identifying it with the electricity of the laboratory was but one of his important contributions to meteorological science. In 1747, while taking observations at Philadelphia of a lunar eclipse, in co-operation with his brother at Boston, he learned that storms moving from the west, as all storms of the middle latitudes do, first begin with easterly winds, as they approach a place of observation, not westerly, and he came near discovering the cyclonic system of storms. Following the winter of 1783, famous in history for the phenomenal severity of its cold, and its long duration, Franklin, in a letter to a correspondent in Europe, called attention to the violent eruption of Mount Hecla the preceding year, and suggested that the dust therefrom may have been carried into the high strata of the atmosphere and spread around the earth by the winds. His idea was that this dust would screen off some of the sun's rays and add to the cold of winter. As in many other things, he had a prophetic vision, for there no longer is doubt that violent volcanic eruptions throw into the upper air large quantities of dust particles which, by swiftly moving easterly currents in the middle

latitudes and westerly currents in the Tropics, are soon so distributed around the earth as not only to effect the colors of the sky for two or three years after, but to modify the weather. Doubtless the earth, in this year of 1916, still is feeling the cooling effects of the explosion of Katmai, in the Alaskan Peninsula, in 1912, augmented by volcanic explosions in Japan in 1913.

The author of the Declaration of Independence, Thomas Jefferson, took daily observations of the weather. He even carried his thermometer to Philadelphia and twice recorded the temperature of Independence Hall on July 4, 1776. He owned one of the only two barometers then in the country. In coöperation with James Madison (after Bishop), who lived at Williamsburg, some two hundred miles east of Monticello, he determined that changes in the barometer first begin several hours earlier at the westernmost station. The British ransacked his home and broke his barometer. It is said that he berated them more for the destruction of his cherished instrument of the weather than he did for their burning of the National Capitol.

As early as 1735 Hadley, an Englishman, had published an article explanatory of the trade winds, and Dalton, another Englishman, in 1793, made the first attempt to explain the phenomena of the atmosphere through the principles of philosophy. It was then believed that storms were straight-line gales. It remained for Redfield, an American, in 1831, to publish an epoch-making essay, in which storms were described as progressive whirlwinds, turning counter-clockwise, with an easterly movement of translation for the whole system of spirally inflowing air. Espy followed, in 1841, and showed that rainfall is caused by ascending currents, cooling by expansion as they rise until the water vapor becomes saturated. By the same line of

reasoning he explained how descending air must heat by compression. In 1843 Tracy made an important contribution to the subject. Redfield had claimed that the air in storm whirls neither moves in concentric curves nor along radial lines into the interior of the storm, but spirally inward. Tracy proved that Redfield was right, for he showed that the rotation of the earth must deflect all air currents to the right of the initial direction in the Northern Hemisphere, whether in storm whirls or out of them. From 1840 to 1860 the other Americans who added most to our knowledge of meteorology were Coffin, Maury, Henry and Loomis. Matthew Fontaine Maury, of the U. S. Navy, was the pioneer in marine meteorology. He mapped the oceans and determined the direction and force of winds and water currents. In 1855 he published his "Physical Geography of the Sea and its Meteorology."

The invention of the electric telegraph made it possible to apply the developing science of meteorology to the art of weather forecasting. Professor Joseph Henry, of the Smithsonian Institution, in 1856, was the first person in this country (probably in the world) to collect by telegraph simultaneously taken daily observations of the weather and plot them on a publicly displayed map, although it does not appear that predictions were published or made, except in a tentative way. His demonstration showed, however, the feasibility of a National Weather Bureau, such as Doctor Increase A. Lapham, of Wisconsin, had diligently advocated for several years preceding, and such as Maury had suggested as a result of his studies of the storms of the sea and as Redfield had recommended in 1846. Henry's map was discontinued after having been in operation only a short time, as was a weather report issued by Professor Cleveland Abbe at Cincinnati, in

the fall of 1869, with the aid of the Western Union Telegraph Company and the Cincinnati Board of Trade. But the persistent study of Lapham in taking simultaneous observations with Dr. Asa Horr, of Dubuque, Iowa, 1853 and along to 1860, and the publishing of results in the Milwaukee Sentinel in 1861, showing, as Jefferson and Madison had done in Virginia, that weather changes also progress from the West in the Mississippi valley; and his work in collecting and compiling records of the loss of life and property on the Great Lakes due to storms, and his petitions to legislative, commercial and scientific bodies was mainly and immediately responsible for the resolution introduced in Congress by General Halbert E. Paine, of Wisconsin, in 1870, that finally initiated a weather-forecasting system in the United States that has grown to be the largest of its kind in the world and more intimately to serve the people than does any other. Dr. Lapham declined a position at the headquarters of the new service in Washington but did serve for a time at Chicago, where he received the observations from other cities, made a weather map and issued the first government forecasts, or probabilities, as they were called at that time. Prof. Abbe was appointed an assistant to the chief at this time, which position he held to the day of his death in 1916.

Until 1891 the service was a part of the Signal Corps of the U. S. Army, and the chiefs were, in the order of service, General Albert J. Meyer, General Wm. B. Hazen, and General A. W. Greely. It then became a Bureau in the Agricultural Department, with Professor Mark W. Harrington as chief, who served four years and was succeeded by Professor Willis L. Moore, who directed its affairs for eighteen years, and was succeeded by Professor Chas. F. Marvin.